Economics 101A
(Lecture 27)

Stefano DellaVigna

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Outline

1. Hidden Action (Moral Hazard) II

2. The Takeover Game

3. Hidden Type (Adverse Selection)

4. Evidence of Hidden Type and Hidden Action

1 Hidden Action (Moral Hazard) II

- Example: *Shareholders and CEO*
- Risk-averse Agent chooses effort e (unobserved)
- Principal pays a salary w to the agent
- First Best: Salary can be a function of effort e –>
  - Ask for 'high' effort e s.t. $c'(e^*) = 1$
  - Pay flat wage as long as $e = e^*$
- Hidden Action: Salary can only be function of $y = e + \varepsilon$
  - Contract pays wage function of output: $w^* = a^* + b^* y$, with $b^* > 0$
  - Effort chosen by agent sub-optimal: $c'(e^*) < 1$

- Assume $c(e) = ce^2/2$ to fully solve

- Remember:

$$e^* = \frac{1}{c}\frac{1}{1+\gamma\sigma^2 c}$$

- What is contract offered to agent?

  - Solution required $c'(e^*) = b^*$ (effort minimization of agent) –> $b^* = ce^*$

  - Implies

$$b^* = ce^* = c\frac{1}{c}\frac{1}{1+\gamma\sigma^2 c} = \frac{1}{1+\gamma\sigma^2 c}$$

- Notice $0 < b^* < 1$:

  - Agent gets paid increasing function of output to incentivize

- Does not get paid one-on-one ($b = 1$) because that would pass on too much risk to agent
- (Remember $w^* = a^* + b^* y = a^* + b^* e + b^* \varepsilon$)
- Comparative Statics: what happens to b^* if $\gamma = 0$ or $\sigma = 0$? Interpret

- What about a^*?
  - Individual rationality constraint:

$$\begin{aligned} a^* &= -b^* e^* + \frac{\gamma}{2} b^2 \sigma^2 + c(e^*) = \\ &= -\frac{1}{c}\left(\frac{1}{1+\gamma\sigma^2 c}\right)^2 + \frac{\gamma}{2}\left(\frac{1}{1+\gamma\sigma^2 c}\right)^2 \sigma^2 \\ &\quad + \frac{1}{2c}\left(\frac{1}{1+\gamma\sigma^2 c}\right)^2 \\ &= \left(\frac{1}{1+\gamma\sigma^2 c}\right)^2 \left(\frac{1}{2c} + \frac{\gamma}{2}\sigma^2\right) \end{aligned}$$

  - Notice: $a^* > 0$ even if not risk averse ($\gamma = 0$) –> Need to compensate for cost of effort

- Summary of hidden-action solution with risk-averse agent:

- **Risk-incentive trade-off:**
  - Agent needs to be incentivized ($b^* > 0$) or will not put in effort e
  - Cannot give too much incentive (b^* too high) because of risk-aversion
  - Trade-off solved if
    * Action e observable OR
    * No risk aversion ($\gamma = 0$) OR
    * No noise in outcome ($\sigma^2 = 0$)

- Same trade-off applies to other cases

- Example 2: *Insurance* (Not fully solved)
  - Two states of the world: Loss and No Loss
  - Probability of Loss is $\pi(e)$, with $\pi'(e) < 0$
    - Example: Careful driving (Car Insurance)
    - Example: Maintaining your house better (House insurance)
    - Agent chooses quantity of insurance α purchased
  - Agent risk averse: $U(c)$ with $U' > 0$ and $U'' < 0$

- Qualitative solution:
  - No hidden action –> Full insurance: $\alpha^* = L$
  - Hidden action –>
    - Trade-off risk-incentives –> Only Partial insurance $0 < \alpha^* < L$
    - Need to make agent partially responsible for accident to incentivize
    - Do not want to make too responsible because of risk-aversion

2 Takeover Game

- "The Takeover Game" (Samuelson and Bazerman, 1985)

- See hand-out

3 Hidden Type (Adverse Selection)

- Solution of Take-over game
  - When does seller sell? If bid profitable ($b \geq V$)
  - Profit of buyer? $1.5V - b$ –> BUT: Must take into account strategic behavior of seller

- Solution:

$$\begin{aligned} & E[profit(b)] = (E[1.5V|V \leq b] - b) \cdot \Pr(V \leq b) \\ = & \left(1.5\frac{b}{2} - b\right) \Pr(V \leq b) \\ = & -.25b \Pr(V \leq b) \end{aligned}$$

- Derive First order condition
  - Solution: $b^* = 0$!

- No market for take-overs, despite clear benefits. Why?

- First type of asymmetric information problems: Hidden Action (Moral Hazard)
  - Manager can shirk when she is supposed to work hard.

- Second type of asymmetric information problems: Hidden Type (Adverse Selection)
  - Informational problem: one party knows more than the other party.
  - Example 1: wisdom teeth extraction (Doctors are very prone to recommend extraction. Is it necessary? Or do they just want to make money. Likely too many wisdom teeth extracted.)
  - Example 2: finding a good mechanic. (Most people don't have any idea if they are being told the truth. People can shop around, but this has considerable cost. Because of this, mechanics can sometimes inflate prices)

- **Lemons Problem**

- Classic asymmetric information situation is called "Lemons Problem"
  - (Akerlof, 1970) on used car market
  - Idea: "If you're so anxious so sell to me do I really want to buy this?"

- Simple model:
  - The market for cars has two types, regular cars (probability q) and lemons (probability $1 - q$).
    - To seller, regular cars are worth \$1000, lemons are worth \$500.
    - To potential buyer, regular cars are worth \$1500 and lemons worth \$750.

- Which cars should be sold (from efficiency perspective)?
  - All cars should be sold since more valuable to buyer.
  - BUT: buyers **do not know** type of car, sellers **do know**
- Solve in two stages (backward induction):
  - Stage 2: Determine buyers willingness to pay
  - Stage 1: Determine selling strategy of sellers
- Stage 2. What are buyers' WTP?
  - Expected car value $= \mu 1500 + (1 - \mu)750 = 750 + \mu 750$
  - Notice: μ is expected probability that car sold is regular (can differ from p)

- Buyer willing to pay up to $p = 750 + \mu 750$

- Stage 1. Seller has to decide which car to sell
  - Sell lemon if $500 \leq p = 750 + \mu 750$ YES for all μ
  - Sell regular car if $1000 \leq p = 750 + \mu 750 \Leftrightarrow \mu \geq 1/3$

- Two equilibria
  1. If $q \geq 1/3$: *Sell both types of cars* –> $\mu = q \geq 1/3$ –> $p^* = 750 + \mu 750$
  2. If $q < 1/3$: *Sell only lemons* –> $\mu = 0$ –> $p^* = 750$

- Market for cars can degenerate: Only lemons sold

- *Conclusion*: the existence of undetectable lemons may collapse the market for good used cars

- *Basic message*: If sellers know more than buyers, buyers must account for what a seller's willingness to trade at a price tells them about hidden information

- Same issues apply to:
  - *Car Insurance.* If offer full insurance, only bad drivers take it
  - *Salary.* If offer no salary incentives, only low-quality workers apply

4 Evidence of Hidden Type and Hidden Action

- Consider asymmetric information in lending market (Karlan-Zinman, 2007)

- Lenders offer different borrowing rates
  - High interest rates –> *Adverse selection:* Tend to select bad borrowers
  - *Moral Hazard:* Borrowers have incentive to default on loan

- Both forms of asymmetric information lead to defaults

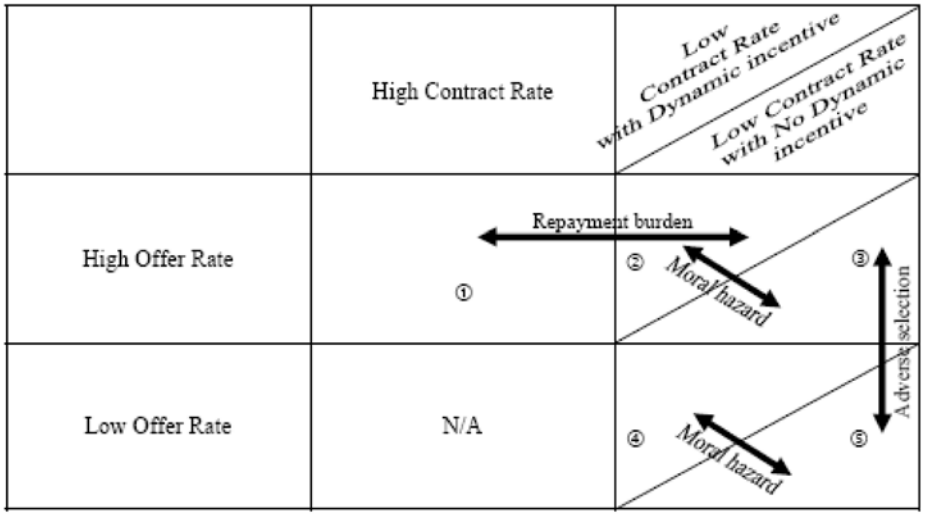
- Separate the two:

– Randomize high and low credit offer

– To some (randomized) high-offer consumers, lower rate ex-post

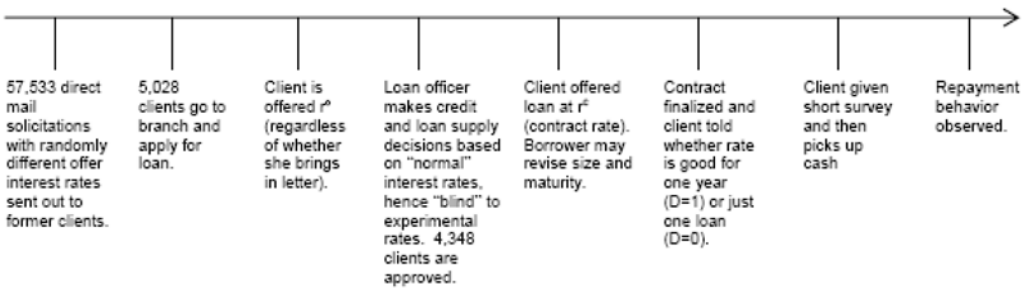
– To some (randomized) high-offer consumers, offer incentives to keep good credit (can keep loan ex post if repay in time

Figure 1. Basic Intuition Behind the Experimental Design



- Timing:

Figure 2: Operational Steps of Experiment



- Results:

Table 3. Identifying Adverse Selection, Repayment Burden, and Moral Hazard: Comparison of Means

		Selection Effects			Repayment Burden Effects		
		High Offer, Low Contract	Low Offer, Low Contract	t-stat: diff≠0	High Offer, High Contract	High Offer, Low Contract	t-stat: diff≠0
Full Sample		(1)	(2)	(3)	(4)	(5)	(6)
	Average Monthly Proportion Past Due	0.102	0.082	1.90*	0.105	0.102	0.23
		(0.009)	(0.004)		(0.006)	(0.009)	
	Proportion of Months in Arrears	0.211	0.202	0.72	0.244	0.211	2.38**
		(0.011)	(0.006)		(0.008)	(0.011)	
	Account in Collection Status	0.123	0.101	1.50	0.139	0.123	0.99
		(0.013)	(0.007)		(0.009)	(0.013)	
	# of observations	625	2087		1636	625	

Moral Hazard Effects		
No Dynamic Incentive, Low Contract	Dynamic Incentive, Low Contract	t-stat: diff≠0
(7)	(8)	(9)
0.094	0.079	1.94**
(0.006)	(0.005)	
0.217	0.188	2.70***
(0.008)	(0.008)	
0.118	0.092	2.16**
(0.008)	(0.008)	
1458	1254	

- Substantial effect of incentives to keep good credit (moral hazard)

- Some effect of adverse selection

- Importance of field experiment: Can do controlled test of theory

5 Next lecture

- Examples of Empirical Economics
  - House insurance
  - Save More Tomorrow
  - Fox News